

VISTAS

Visualization of Terrestrial & Aquatic Systems

Exploring data on topographically complex landscapes

<http://blogs.evergreen.edu/vistas>

An Interdisciplinary Team of
Computer Scientists, Social Scientists and Environmental Scientists



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Acknowledgements

VISTAS team: prior developers: Viriya Ratanasanpunth, Chris Schmidt, Patrick Wingo, Justin Mangué, Kendra Schmal. PhD student: Kirstsen Winters. Sr. Personnel: Susan Stafford.

VISTAS collaborators & users: Robert Kennedy, Bob McKane, John Bolte, Christoph Thomas, Allen Brookes, Patrick Wingo, Dominique Bachelet, Larry Mahrt, Jonathan Halama

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1. What is VISTAS – goals & objectives
2. Some VISTAS visualizations
3. Features
4. Demo
5. Futures
6. Becoming a VISTAS user
7. More info, contact us & discussion

VISTAS Goal

...research, develop, and validate *visual analytics* –
so environmental scientists can
better understand and communicate
ecological processes that
span spatial and temporal scales.

VISTAS' niche: *Topography matters!*

*The effects of **complex topography over time**
on ecological processes is
poorly understood and difficult to study.*

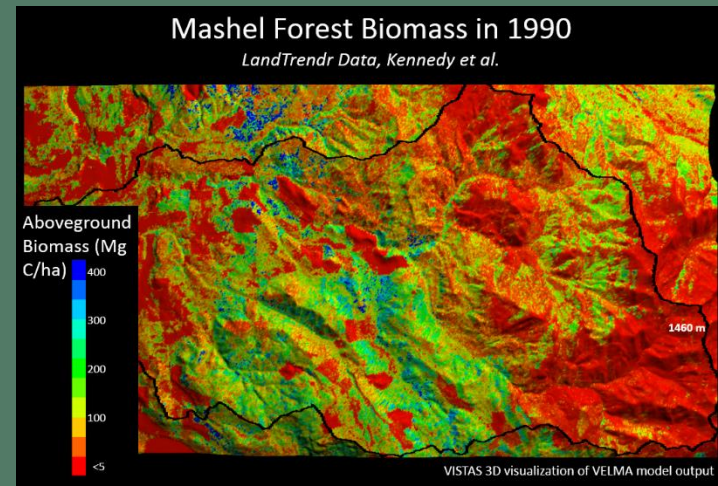
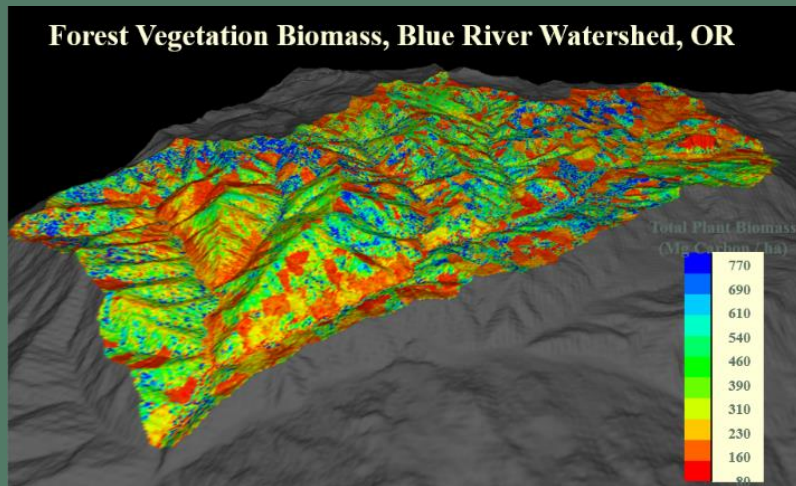
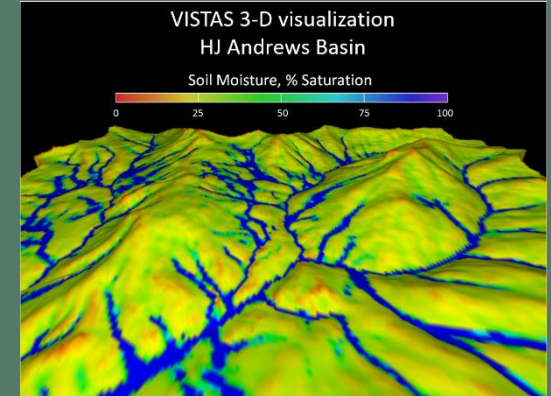
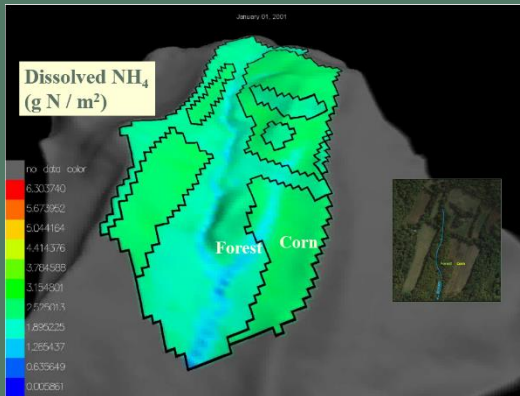
VISTAS Objectives

1. **Conduct research & co-develop a proof of concept: VISTAS**
2. **Conduct environmental science research using VISTAS**
3. **Study VISTAS' co-development, visual analytics, usability**

VISTAS Objectives

1. Conduct research & co-develop a proof of concept: VISTAS
A C++ prototype, freely available for Windows, that uses modern graphics (GPUs), and takes as input
 - Gridded ASCII, NetCDF or shapefiles,
 - Geographic locations (coordinates) and desired resolution.
2. Conduct environmental science research using VISTAS
Address *wicked problems* presented by climate change and complex systems
3. Study VISTAS' co-development, visual analytics, usability
 - Which vis works – for scientists? for decision makers?
 - What do users need to know to use VISTAS?
 - What should co-developers know –
when developing software to address wicked problems?

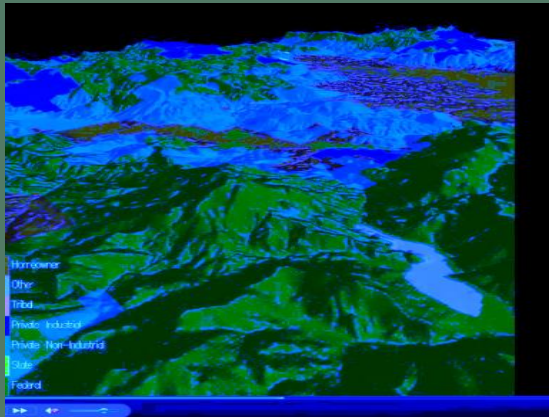
Some VISTAS Visualizations



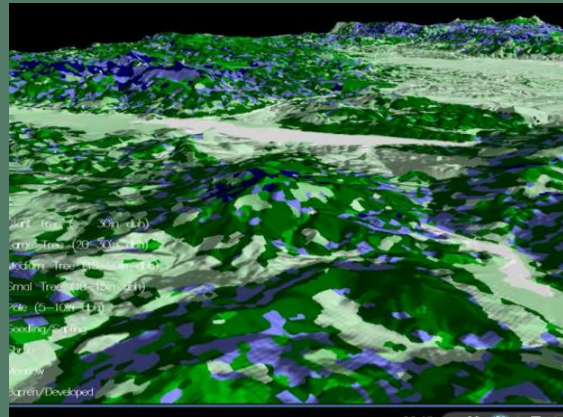
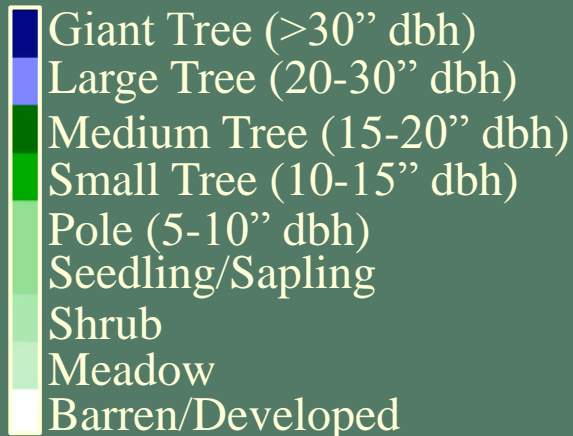
For more images, view the gallery at: <http://blogs.evergreen.edu/vistas/>

June 11, 2014 VISTAS Flythrough, Lakeview, Oregon

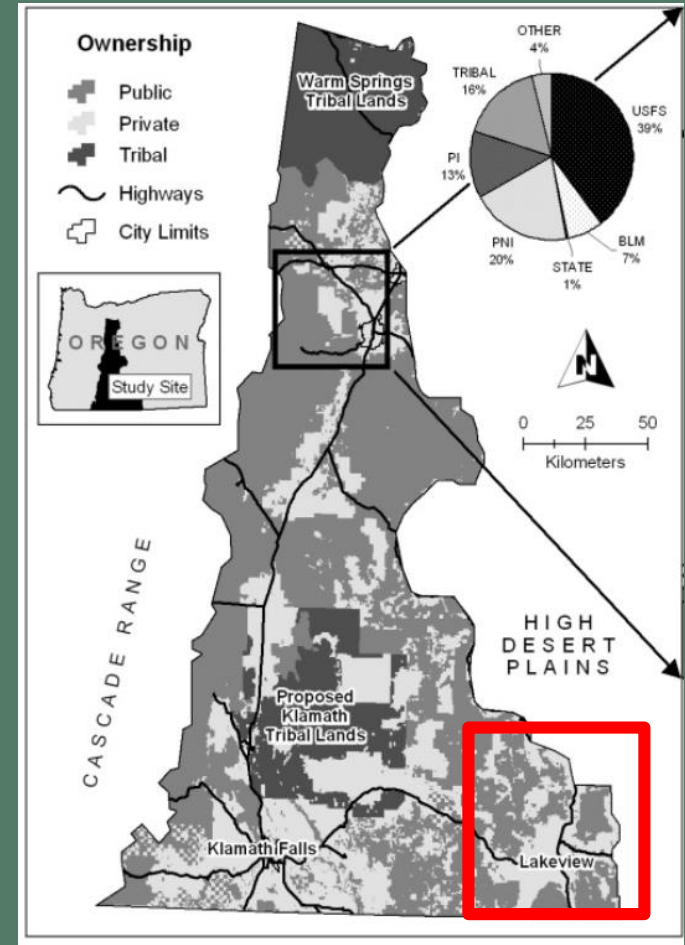
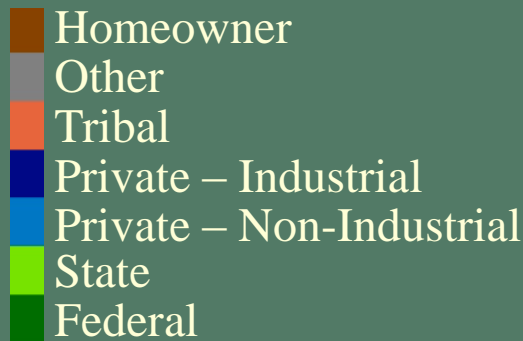
Given two ENVISION shapefiles, VISTAS generated stills and flythroughs of a single time slice to show fire disturbance potential



Vegetation size (habitat)



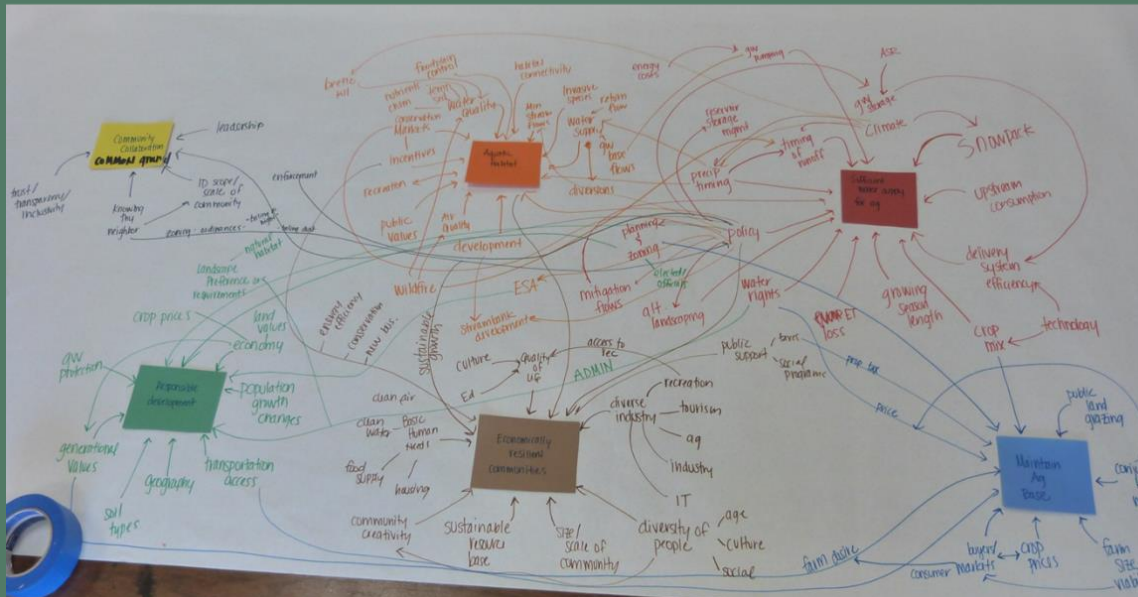
Ownership



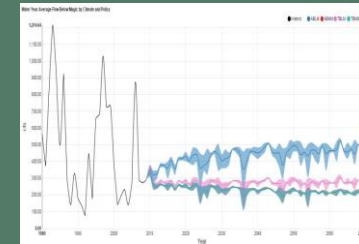
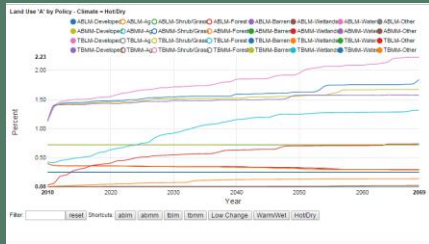
Alternative Land-Use Scenarios

Big Wood Basin (Idaho)

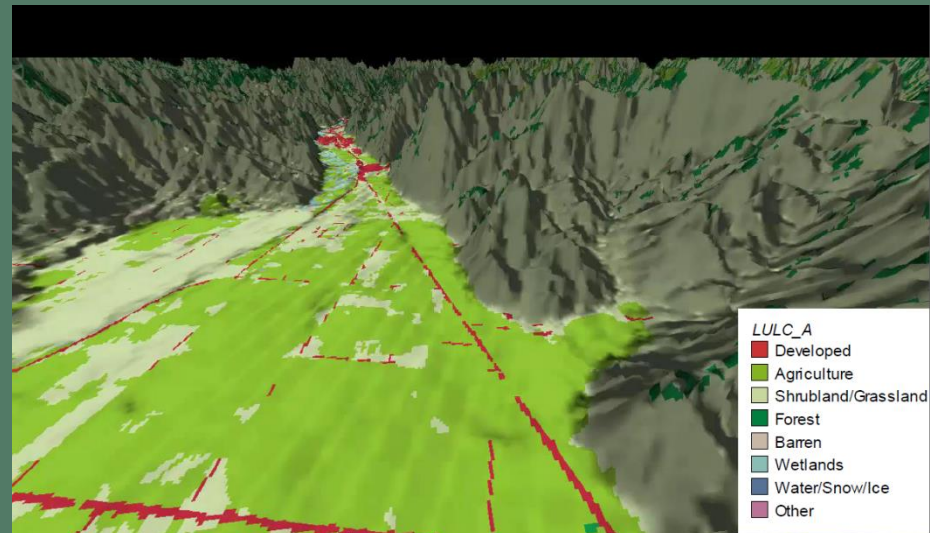
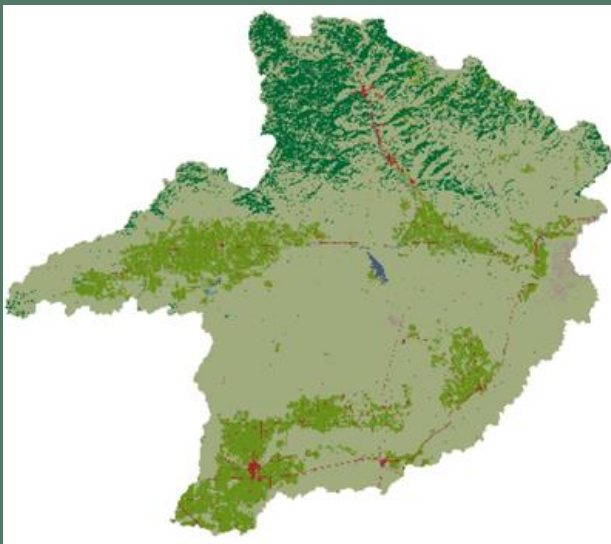
Co-developing Knowledge



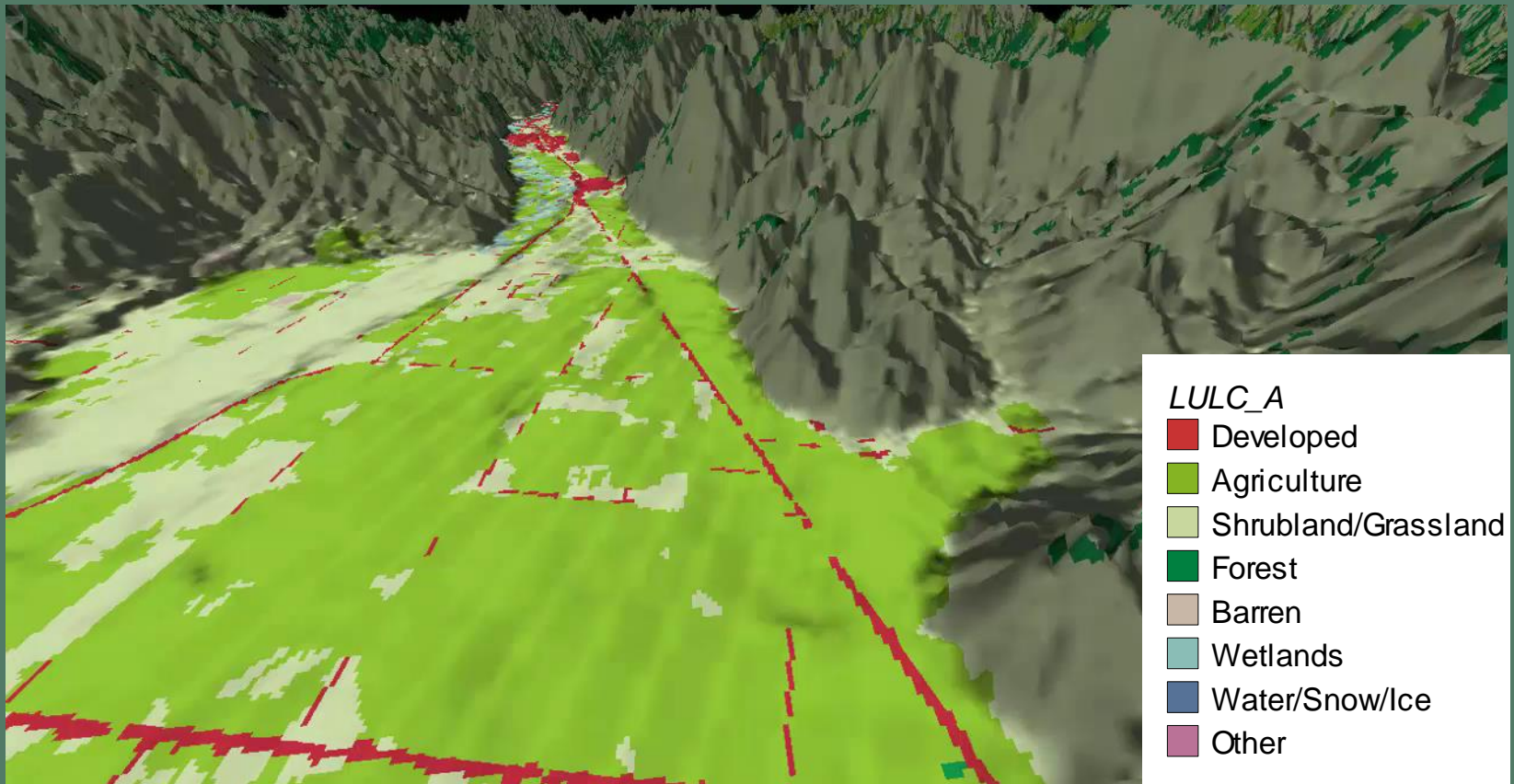
Alternative Land-Use Scenarios Big Wood Basin (Idaho)



From line charts and bar graphs to 3D landscapes



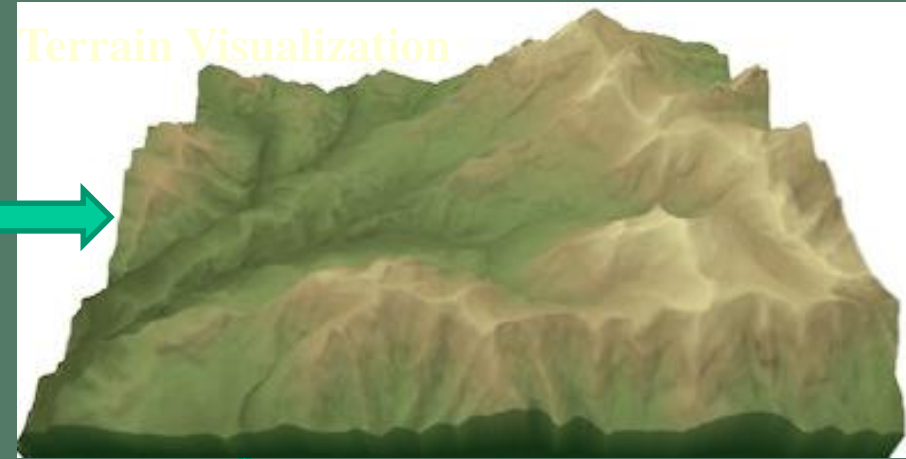
Big Wood: flythrough video



2014 Web Prototype

Visualize Wind Flow at HJ Andrews LTER (Oregon)

'Flat' topo maps are difficult to read



Wind Flow over time

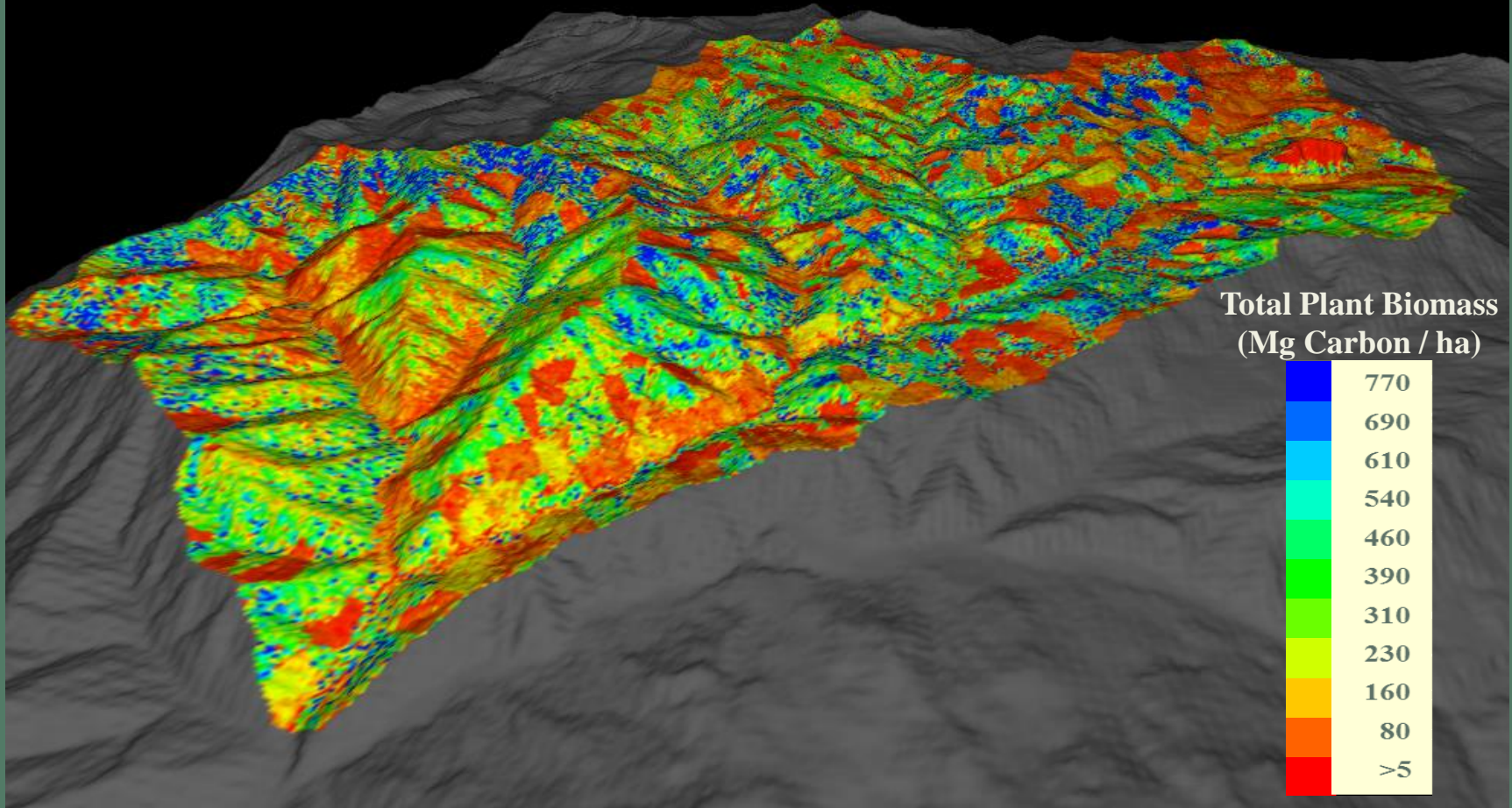


Zoom in on valley of interest

Hydrological-Biogeochemical Processes

Topography is important

Forest Vegetation Biomass, Blue River Watershed, OR

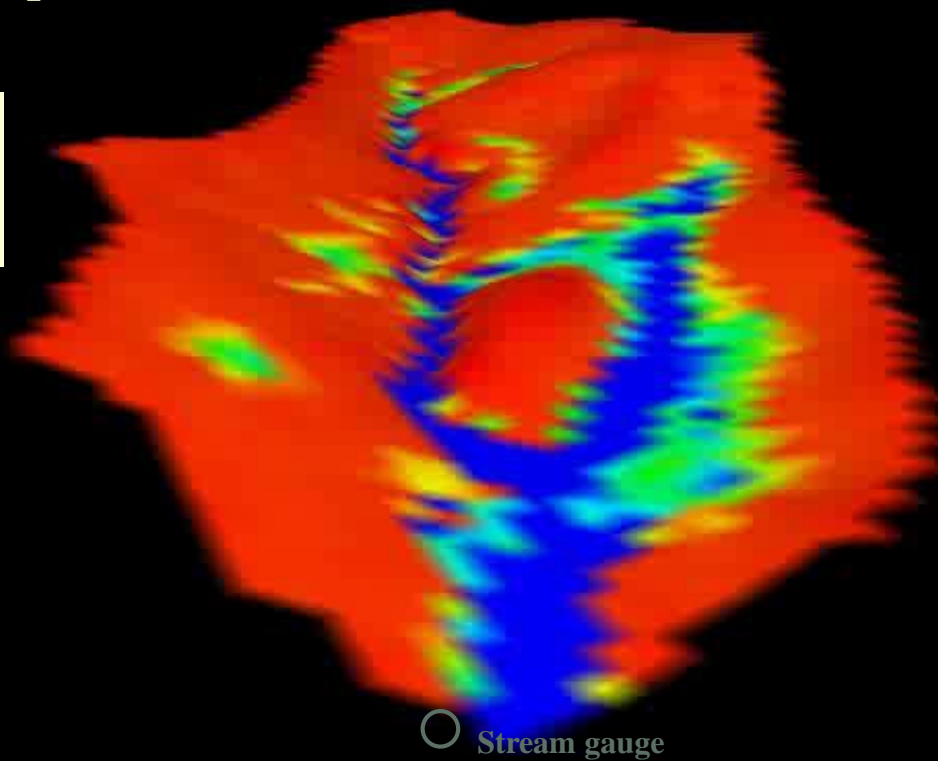
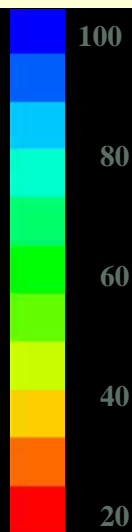


Soil Moisture
2000-01-01

Do forest buffers reduce runoff to Chesapeake Bay?

Animation illustrates processes over time

Soil Moisture
(% Saturation)



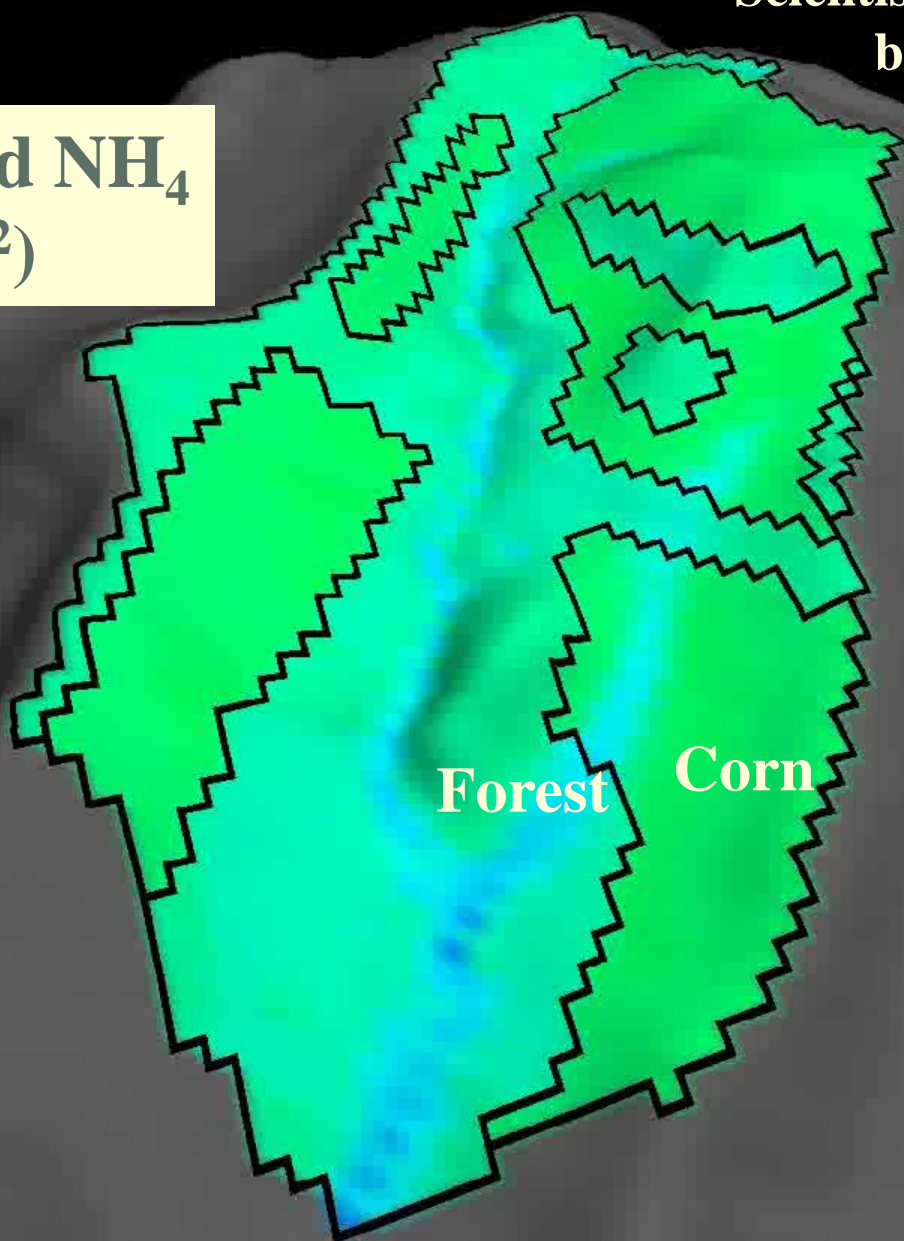
Simulated Streamflow, mm/day



January 01, 2001

Scientists had internalized land use boundaries, but stakeholders needed these

Dissolved NH₄
(g N / m²)



VISTAS Features (overview)

- **Given:**
 - gridded data of one or more features
 - elevation data of area of interest
- **VISTAS will**
 - generate a “3D” map, and
 - drape the feature(s) across the landscape
- **You can then**
 - view & explore the map
 - *over time—animation*
 - *over space—flythrough*
 - *over data—inspect, filter*
 - annotate the map with 2D graphs of related variables
 - label the map for clarity
 - use the map to validate or debug data and/or models
 - save your project with visualization(s)
- **Export visualizations for presentation**

A VISTAS Demo:

Try VISTAS...

<http://blogs.evergreen.edu/vistas/>

At [...vistas/vistas-software](http://blogs.evergreen.edu/vistas/vistas-software) you will find:

- VISTAS Introduction (these slides +)
- How to download VISTAS EXE & sample files
- User documentation
 - Quickstart manuals
 - How to videos
- Developer documentation
- Links to freely available source files

NOTE: Some experience with GIS software will be helpful.

VISTAS' Futures

1. Refine & Sustain the Software

Better documentation

Improved usability & extensibility

Community sustainability

2. Getting to Why

Enhanced visualization – flow

Visual analytics, machine learning

- Identification & detection of hot spots (features)

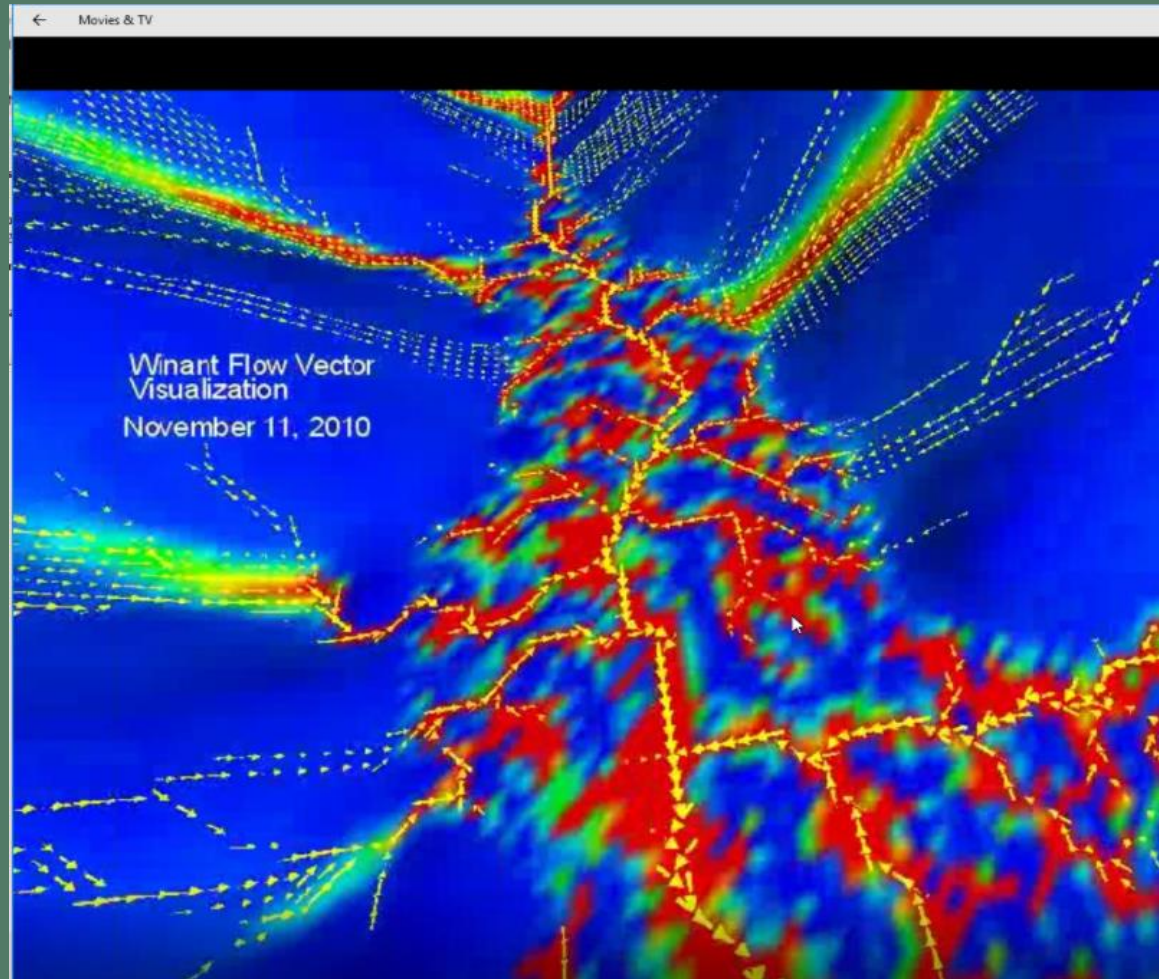
- Where and why features change over time

3. Social Science Research

Which visualizations work, for whom, when

Hydrological-Biogeochemical Processes an Oregon salt marsh

- Arrows indicate flow direction
- Background colors, magnitude of groundwater lateral flow
- Soil moisture is predicted by a hydrological model
- Water flow is based on topography



Video at:

<https://www.dropbox.com/s/s5rtf93wx3uewk4/myvectortest.wmv?dl=0>

Contact Us

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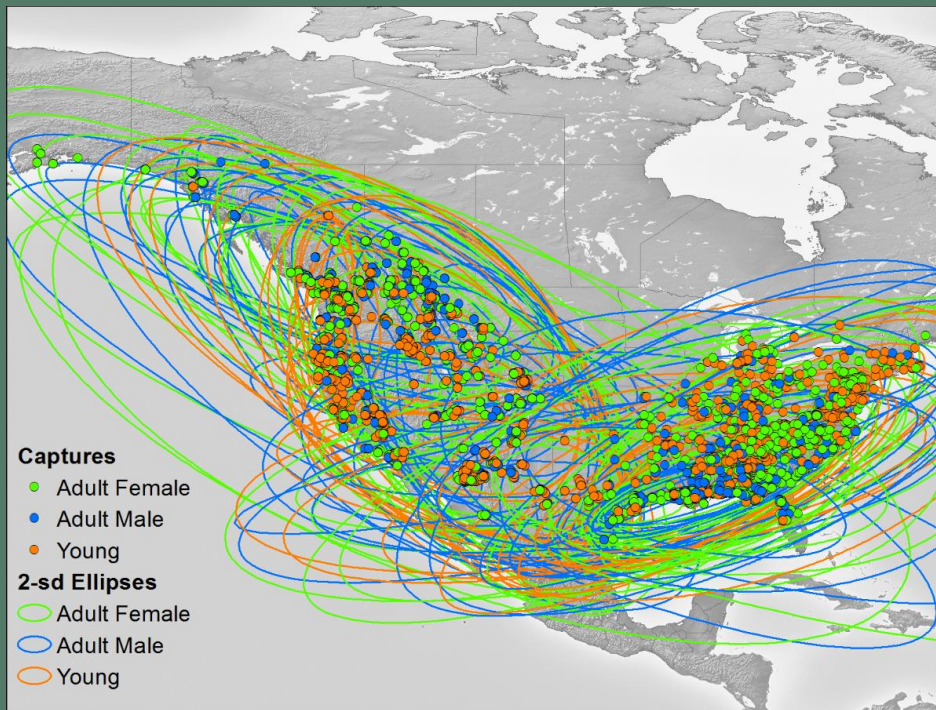
Taylor.mutch@cbi.org

NSF ABI-BIO 10-62572,

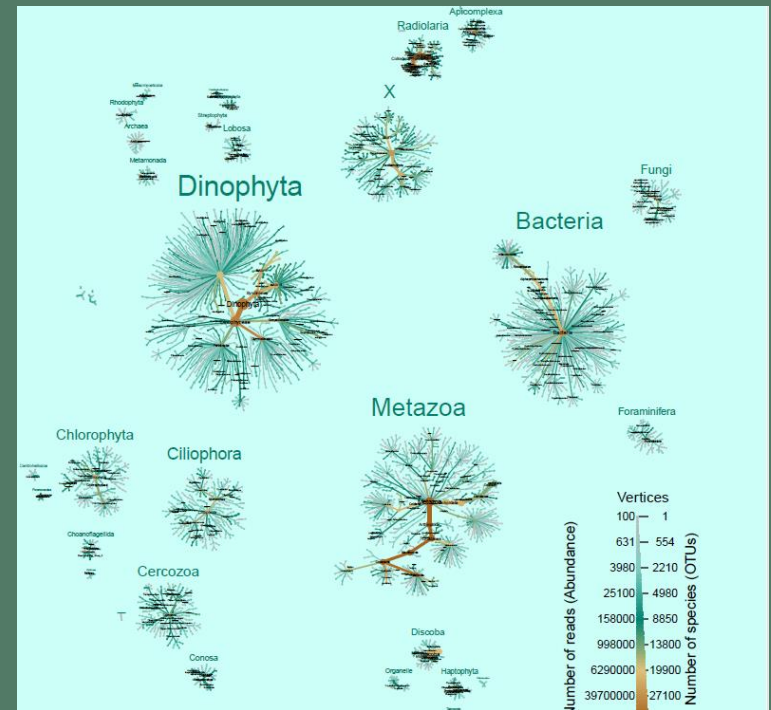


The PNW EcoVizzies 2016

Stay tuned for the 2017 contest !!!!
Please submit your visualization(s)!



Large scale migration patterns
of Rufous Hummingbirds
(Josee Rousseau)



Eukaryotic plankton diversity in
sunlit ocean (Tara Foster)

VISTAS Backstory

NSF DBI 04-17311, CISE 01-31952, BIR 03-19309, 99-75510, 96-30316, 93-07771

<http://canopy.evergreen.edu/scidb>

<http://archives.evergreen.edu/webpages/projects/scidb/index.html>



The Evergreen State College

Project Vision

Certain ecology problems require ecological synthesis, which requires synthesis and integration, which in turn requires better data management tools. We focus on tools for the individual ecologist to better conceive, manage, visualize, and analyze data sets. We cannot de-couple the ecology from data management "solutions", so our project involves the study of structural complexity over a 1000-year chronosequence (1KCS) in the Pacific Northwest.

Canopy Database Project

Data Management and Visualization for Forest Ecologists

<http://canopy.evergreen.edu/canopydb>

Judy Cushing, Nalini Nadkarni

Anne Fiala, Lee Zeman

Jesse Cantin, Chris Pierce

The Evergreen State College

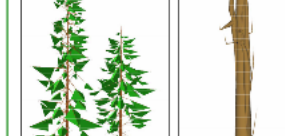
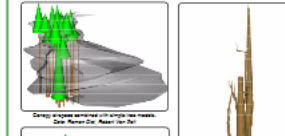
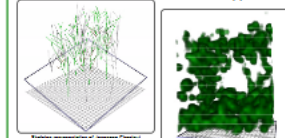
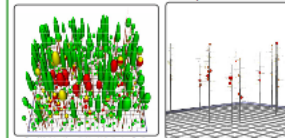
Collaborating Ecologists & NSF LTER Information Managers:
Bond, Dai, Ishi, Parker, Shaw, Sillett, Burnsia, Brunt, Kasian, Menendez, Ramsey, Stafford, Vanderbilt, Walsh

Collaborating Computer Scientists:
Dave Meier, Lois Delcamare, Jim Thomas

Long Term Ecological Research in Old Growth Forests (LTER OG) is a project of the National Science Foundation (NSF) and the National Science Foundation (NSF) Office of Biological Services (OBS).



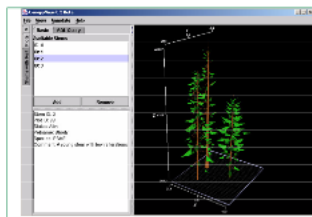
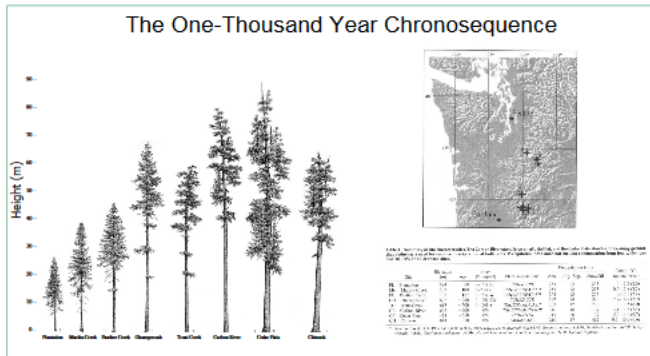
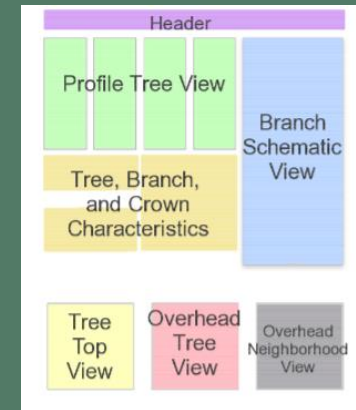
CanopyView Visualization from Components



Future Work

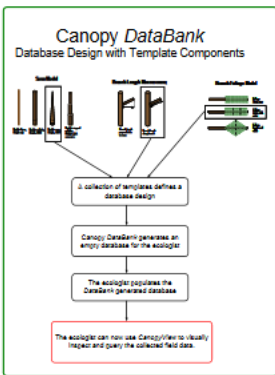
Integration of a database integration tool (e.g., a "GIS" project) to enable easier integration of non-CanopyView data.
Better generation and utilization of models for validation and analysis, and of 3D, a statistical analysis suite (especially for canopy structure) and use as standard analyses performed by forest canopy researchers, and probably in R.

1994 – 2006
Manage & visualize
Canopy
Science
field data



CanopyView is a visualization tool for forest ecologists. CanopyView contains a library of visualization modules that are loosely coupled to the Canopy DataBase's library of data structure templates. A collection of templates defines a database design that can be generated and downloaded from the Canopy DataBase. Certain templates have a visualization associated with them. If one of these templates is used to create an Access database then CanopyView can extract and visualize this data. CanopyView can be used to visually integrate data from multiple databases.

CanopyView is currently under development. See <http://canopy.evergreen.edu/CanopyView>



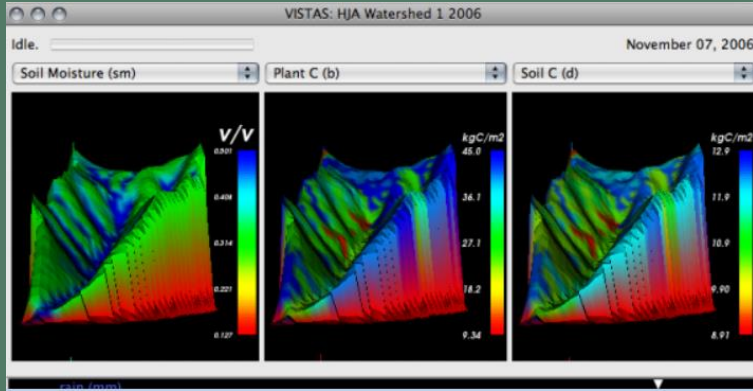
Please ask us for a demo!



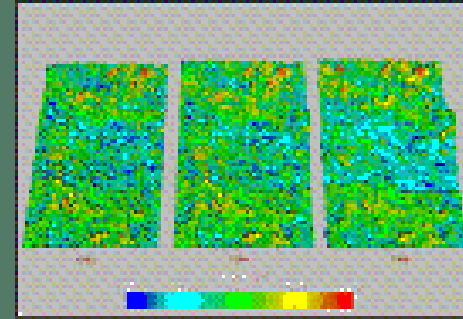
WA DNR
Leave Tree Project₂₂

VISTAS Backstory (2005 - 2010)

toward terrain modeling & animations over time



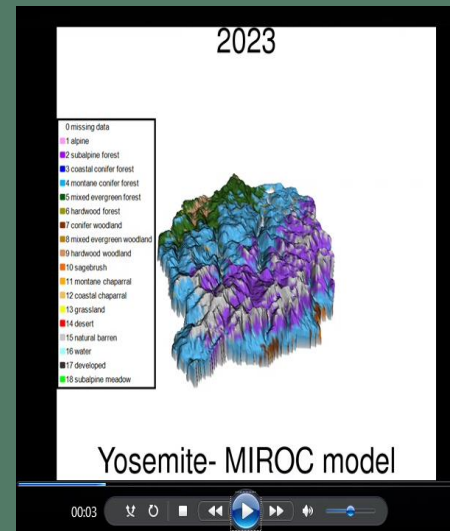
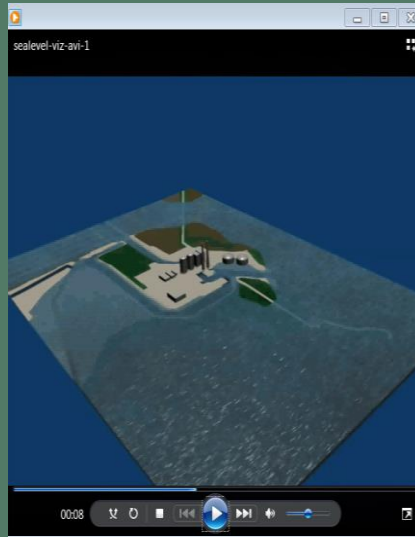
Comparing
Soil Moisture, Plant and Soil Carbon at
the HJA LTER



View forest regrowth after
hurricane disturbance
Luquillo LTER, Puerto Rico



Sea Level Rise
Turkey Pt,
St. Lucie
nuclear reactors



Vegetation change
due to projected
climate change

VISTAS

Ongoing Social Science Research

Which visualizations work, for whom?

Characterizing Scientists' Needs

	EXPLORATION	COMMUNICATION
CHALLENGES	<ul style="list-style-type: none">• combining statistics & visualization• separating signal from noise• data variety & volume	<ul style="list-style-type: none">• validating results• simplifying results• externalizing complex thought experiments• representing uncertainty
OPPORTUNITIES	<ul style="list-style-type: none">• visualization<ul style="list-style-type: none">- 3D models- multiple scales (spatial & temporal)	<ul style="list-style-type: none">• photorealism?• “audience” appeal• real-time visual analytics

Ask VISTAS Science Collaborators

“Which visualizations work, for whom?”

	<u>Scientists</u>	<u>Stakeholders</u>
ENVISION	Not needed. ENVISION vis – flat & polygonal but sufficient	People think in landmarks: <u>3D maps</u> draw them in. <u>Animation</u> holds attention
VELMA	<u>3D movies and graphics</u> illuminate interactions & system level controls	<u>3D still landscapes</u> – reveal how environment changes Not interested in <u>why</u>
MICRO-MET	<u>3D wind stills & animation</u> Help build a model from sensed data	<u>Stakeholders ARE scientists</u>
CLIMATE CHANGE IMPACTS	<u>3D movies and graphics</u> illuminate interactions When, where, what, WHY?	<u>3D movies and graphics</u> illuminate interactions Want to know why....